**Class:** Electrical Troubleshooting & Preventative Maintenance

**Description:**

This course teaches students common-sense electrical troubleshooting techniques so they can keep their facilities and equipment up and running. They will also learn how to protect themselves from serious injury while troubleshooting. This class is designed for anyone who needs to sharpen their electrical troubleshooting skills in order to increase efficiencies and uptime at their industrial plant or building facility. This is a “hands-on” class and the goal is for students to be able to go back to their workplace and immediately apply what they have learned.

**Presentation:** Classroom - lecture and hands-on exercises

**Anticipated size:** Maximum 20 students

**Attendance Verification:**

 All students must sign in both days, provide their ID card, and note their state license number on the sign-in sheet to apply for Continuing Education Units in their state. The rosters are kept on file for three years at TPC Trainco headquarters and will be submitted in accordance with the state’s requirements.

**Participant Evaluation:**

 Every student that attends the full training session will receive a three star certificate of completion at the end of the course, as well as complete a training evaluation form. A proctored exam is not required to complete this class, although the option of an online or paper mail-in exam is available at the student’s request after successful completion. If they choose to take the exam, they will receive an additional four or five star certificate after passing the exam; four if they choose to take it online and five if they choose to get it proctored.

**Fees:** $1100 for 2 days, all materials included

**Material/Visual Aids:** IPET 006 1214 ATMT Electrical Troubleshooting PPT Presentation

WBET 101 1215 ATMT Electrical Troubleshooting Student Workbook

 SGET 101 1215 ATMT Electrical Troubleshooting Study Guide REET 101 1115 ATMT Electrical Troubleshooting Reference Guide NFPA 70E, OSHA 1910, NEC 2014

 Ohmmeters, multimeters, voltage testers, electrical plans/drawings

 Standard A/V equipment, whiteboard

Training Outcomes

At the completion of the course, students will know how to:

* Interpret the OSHA requirements for troubleshooting and working on energized circuits
* Safely and correctly verify a circuit is de-energized.
* Perform basic circuit checks for shorts, opens and ground faults
* Troubleshoot problems using ladder drawings and schematic diagrams.
* Perform continuity and resistance checks on relay coils and contacts, overloads, fuses, circuit breakers, switches and other control circuit components.
* Wire and troubleshoot basic electrical control circuits to develop a logical, systematic approach to troubleshooting
* Troubleshoot 3-phase circuits by taking and interpreting clamp-on ammeter readings
* Measure voltage on 3-phase Wye and Delta connected circuits and calculate percent phase imbalance as part of troubleshooting motors
* Test and troubleshoot single-phase power distribution systems for correct wiring.
* Use a megohmmeter to perform the following insulation resistance tests used on motors and distribution systems: Spot Reading, Dielectric Absorption Ratio, and Polarization Index.
* Observe power quality problems and troubleshooting techniques for facility distribution systems, three-phase loads and commercial lighting.
* Measure VFD output characteristics and observe VFD operation.
* Apply troubleshooting skills to your facility one-line electrical drawings and electrical floor plans.
* Identify components of a successful electrical preventive maintenance program to minimize need for excessive troubleshooting.

Course Outline

**Basic Skills for Electrical Troubleshooting**

• Safety First

• OSHA Requirements Regarding Troubleshooting and Qualified Persons

• Using Electrical Drawings

• Using Meters (multimeters) and Circuit Measurements

• Developing a Logical, Systematic Approach to Troubleshooting

**Troubleshooting Control Circuits**

• Relays, Motor Starters and Control Devices

• Reading and Interpreting Ladder Diagrams

• Power Loss

• Control Circuit Industrial Applications

• Electric Motor Drives

• Solenoid-Operated Valves

• Heating Elements

**Troubleshooting Motors**

• Most Common Motor Problems

• Electrical Problems

• Testing Windings for Shorts, Opens and Ground Faults

• Phase Unbalance

• Mechanical Problems

• Phase Rotation Testing

**Troubleshooting Power Distribution**

• Wye and Delta Systems

• Overcurrent Protection

• Branch Circuits

**Troubleshooting Power Quality Problems**

• Sources of Power Quality Problems

• Test Equipment for Troubleshooting Power Quality Problems

• Harmonics

**Troubleshooting Lighting Circuits**

• Lighting Terminology

• Types of Lighting Circuits

• Incandescent Lighting

• Fluorescent Lighting

• HID Lighting

**Troubleshooting Programmable Logic Controllers (PLCs)**

• Overview of PLCs

• Reading PLC Ladder Diagrams

• Status Indicators and Error Codes

• Force and Disable

• Startup Procedures

**Troubleshooting Variable Frequency Drives (VFDs)**

• VFD Terminology

• VFD Basic Operation

• Components

• Pulse Width Modulation

• Types of VFDs

• Common Problems and Corrective Action

**Electrical Preventative Maintenance**

• Why Perform Electrical Maintenance

• Overview of an Electrical Maintenance Program

• Building Your Own Walk-Through Inspection Checklist

Course Timeline

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| **DAY ONE** |
| **Start Time** | **End Time** | **Hours** | **Topic** |
| 7:30 | 8:00 | .5 | Registration/Sign-In |
| 8:00 | 9:00 | 1 | **Basic Skills for Electrical Troubleshooting** |
| 9:00 | 10:30 | 1.5 | **Troubleshooting Control Circuits** |
| 10:30 | 10:45 | .25 | Break |
| 10:45 | 12:00 | 1.25 | **Troubleshooting Control Circuits (cont’d)** |
| 12:00 | 1:00 | 1 | Lunch |
| 1:00 | 1:30 | .5 | **Troubleshooting Control Circuits (cont’d)** |
| 1:30 | 3:00 | 1.5 | **Troubleshooting Motors** |
| 3:00 | 3:15 | .25 | Break |
| 3:15 | 4:30 | 1.25 | **Troubleshooting Power Distribution** |
| **DAY TWO** |
| **Start Time** | **End Time** | **Hours** | **Topic** |
| 7:30 | 8:00 | .5 | Registration/Sign-In |
| 8:00 | 10:00 | 2 | **Troubleshooting Power Quality Problems** |
| 10:00 | 10:15 | .25 | Break |
| 10:15 | 12:00 | 1.75 | **Troubleshooting Lighting Circuits** |
| 12:00 | 1:00 | 1 | Lunch |
| 1:00 | 2:00 | 1 | **Troubleshooting Programmable Logic Controllers (PLCs)** |
| 2:00 | 3:00 | 1 | **Troubleshooting Variable Frequency Drives** |
| 3:00 | 3:15 | .25 | Break |
| 3:15 | 4:00 | .75 | **Troubleshooting Variable Frequency Drives** |
| 4:00 | 4:30 | .5 | **Electrical Preventive Maintenance** |